Historical background of technology transfer, transformation, and development in japan

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HISTORICAL BACKGROUND OF TECHNOLOGY TRANSFER, TRANSFORMATION, AND DEVELOPMENT IN JAPAN

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CONTENTS

I. INTRODUCTION

1. The research activities of the Japanese Experience Project for the year 1978 constituted the first phase of a five-year research period. The major objective of our project is to examine the self-reliant process of development with respect to technology transfer, transformation, and development that Japan has experienced, taking full account of the various development problems that the developing countries face today. The first-phase research activities were carried out exclusively by Japanese scholars whose reference area is Japan. Questions concerning the various aspects of transfer of Japanese technology to the developing countries are to be taken up at a later stage with the collaboration of institutions and scholars of the developing countries.

2. Although we will take full advantage of the enormous mass of existing academic studies of Japan since the beginning of "modernization"—most of them West European biased—we have tried to examine the Japanese experience from a pluralistic point of view. This pluralism of approach is reflected partially in our project proposal, in which research activities are divided into three levels: Rural and Urban Societies, Particular Industries, and Area Studies. It is also reflected in our division of technology into "hard" and "soft" technology. To our regret, however, because of financial constraints we have not done much in Area Studies except for a preliminary study on Hokkaido.

3. More than twenty papers are being published as the fruit of this first phase of the project. These reports are not presented as conclusive statements but rather are intended to introduce the Japanese experience into a channel of dialogue and academic interaction among those concerned with development issues, by providing materials to be examined at various levels and in various directions. The responses given and questions raised in this dialogue will help shape the work of the advanced phases of the project.

4. The principal methodology adopted heretofore by Japanese scholars examining the Japanese experience has been to focus attention on measuring the distance from the experiences of the most advanced countries. In other words, the experiences of the West European countries have been a model to learn from and a target to be attained. What has been lacking has been dialogue with non-European countries and the attitude of seeking to identify with them.

5. After World War II there were a few who began to undertake dialogue with non-European countries. Until recently, however, they have been a minority, just as those in non-European countries who sought dialogue with Japanese have been few. Today there is an increasing concern with developing countries among Japanese scholars (concurrent with the growing interest in the developing countries on the part of scholars in the developed countries), and a similarly increasing concern with the Japanese experience among scholars of the developing countries.

6. Dialogue with people in the developing countries is likely to be painful for many Japanese intellectuals, since the history of modern Japan for over one hundred years has been one of hurting other nations and of being hurt. Japanese intellectuals wish to play a role in an effort to formulate a new world order. However, they are not yet confident of what they have to do, and this lack of confidence often leads them to take a cautious attitude and to keep a distance from urgent requests for co-operation.

7. There are a number of intellectuals in the third world who are of the opinion that the Japanese experience is worth examining because Japan has been successful in her industrialization. However, they should also pay attention to the cost of industrialization, such as environmental pollution. Japanese intellectuals, though sympathetic enough toward industrialization of the developing countries, cannot advocate such industrialization with confidence because they don't know how to overcome the side effects of this process.

8. From the viewpoint of those who are struggling for survival, the attitude of such Japanese intellectuals may appear to be irresponsible. And in fact, this tendency has been accelerated, particularly since Japan has come to be seen as a big country measured in terms of GNP. However, this image of a great economy is far from the reality for most Japanese.

9. The important thing is that constructive dialogue should take place. It is our hope that our project will provide a place in which every nation will come to realize the fact that every national culture has an equal value and that a great culture should not flourish at the expense of little cultures.

10. After participating in many meetings, symposia, and conferences in connection with the Human and Social Development Programme and also reading the sub-project reports, we have increasingly realized that there may exist a considerable gap between the general understanding of the prospective readers in the third world on modern Japanese history and the contents of reports of each sub-project, and supplementary discussion on what has been assumed by most Japanese scholars seems necessary to make the sub-project reports readable. The present report, therefore, is a background paper, based on the Co-ordinator's own understanding and interpretation of modern Japanese history, depending entirely on the past accumulation of knowledge on the subject in Japan. For the sake of simplicity and readability references and quotations are omitted; these will be systematically arranged at the end of the project period.

II. BEFORE AND AFTER THE MEIJI RESTORATION

1. Arrival of the Kurofune

11. In September 1868 the Japanese government system changed after a period of turmoil of enormous scale that had lasted for more than ten years. The Tokugawa Shogunate had remained in power for about two and a half centuries, controlling 270 feudal clans under a solid centralized administrative system. The Tokugawa Shogunate also monopolized trade by prohibiting the subordinate feudal clans from engaging in trade activities with the outside. This prohibition was aimed at restraining the accumulation of military power by the clans and furthermore at checking the inflow of religion and ideas that might be used for anti-Tokugawa movements.

12. On the other hand, such policies helped to strengthen political integration and to establish a nation-wide market economy in accordance with the development of local industries and cultures corresponding to the status-hierarchy system formulated during the Tokugawa period (in which the classes, ranked in order from top to bottom, were: warriors, farmers, artisans, and merchants). Thus, the basic form of Japanese culture as we recognized it today can be said to have been shaped during the Tokugawa period.

13. Toward the end of the Tokugawa regime, the development of the market economy had enhanced the economic power of merchants and traders to the extent that their power could no more be controlled by the authority. The economy of the feudal clans was being maintained and activated by these merchants, and the economic status of

the lower ranking warriors was already as low as that of commoners and craftsmen.

14. The Tokugawa Shogunate persistently penalized rebellious clans by abolishing or reducing fiefs. Many ronin or unemployed warriors were produced in each case. However, the discontented state of these ronin did not lead them to take action against the Tokugawa regime. Instead, a crisis in the feudal system was felt rather in such incidents as peasant riots demanding a reduction of the revenue rate at times of calamity or poor harvest and protesting the imposition of surtaxes or incidental taxes. These riots again did not aim at replacing the Tokugawa regime with, say, a "Peasant Republic" but were protests directed against notorious bureaucrats and privileged merchants.

15. The crucial impact came from outside Japan in the arrival of the Kurofune ("black ships") in 1853. The commander-in-chief of the East Indian fleet of the United States of America, Matthew C. Perry, came to Japan with a message from the President of the United States asking for the opening of a port. Faced with the military power symbolized by the Kurofune, the Tokugawa Shogunate had to change its policy of seclusionism.

16. A Treaty of Amity and Commerce was concluded between Japan and the United States of America, and similar treaties were concluded also with England, France, Holland, and Russia. Since the regime knew the strength of military power of the European countries from China's defeat in the Opium War (1840-42), the arrival of the Kurofune put the Tokugawa Shogunate in dread of military power of the foreign countries. Moreover, ship-building technology had been almost lost by that time because of the prohibition against constructing big ships.

17. The Tokugawa Shogunate had to lift the policy of seclusionism because there was a great possibility, according to the then

American consul in Japan, Townsend Harris, of Japan's suffering a similar fate to that of China if the country remained close. Harris advocated the conclusion of the Treaty of Amity and Commerce as the only way to save Japan from the threat of England and France, since it would become a duty for the United States of America to regulate any actions taken by England and France if the treaty was concluded.

18. There had been occasions even before Perry's arrival when foreign ships came to visit and asked for the opening up of trade relations with Japan. There were a few intellectuals who felt a crisis from such occasions. Their apprehension was mostly based on the scattered information obtained from Dutch books available at Nagasaki, the only port open to the ships from Holland. Most of them were medical doctors, and it was those doctors who introduced Western sciences and military science and technology as well.

19. Their warnings arguing for coastal defenses, however, were not respected. This was partly because they were a minority in medicine; the majority of doctors at that time were herb doctors. It was also because the core of intellectuals were warriors-cum-administrators (bureaucrats) who specialized in the political philosophy of Confucianism. Even scholars of Western sciences, such as medical doctors, were regarded as humble technicians.

2. Advocacy of Imperial Rule and Exclusionism

20. The warrior class was furious with the submission of the Tokugawa regime to the military overpower of the foreign countries. This gave the momentum for the discontented elements to take action against the regime. Criticism of the Shogunate, in the form of objecting to the opening of a port, sprang up from the economically powerful feudal clans located in the western parts of Japan which had been ill-treated by the Tokugawa family. However, this exclusionism had a weak point in that the discontented warriors did not intend to overthrow the feudal system with which they

identified themselves. Nevertheless, what was crucial is the fact that they were successful in mobilizing village officials, big merchants, and wealthy farmers into this movement by focusing its target on overthrowing the Tokugawa family, not on crushing the feudal system.

21. In the course of the protest movement, the discontented warriors who were critical of the conclusion of treaties with foreign powers by the Tokugawa regime gradually turned their eyes to the existence of the Emperor, who was the only person to legitimize the action taken by the Shogunate. Here they found their way out, preserving their own class interests by overthrowing the Tokugawa family and at the same time extricating the country from the critical situation.

22. The Emperor did not have any practical power in politics and administration, yet took part in the decision-making process in a nominal way. In other words, no decision was finalized without the Emperor's consent. The anti-Tokugawa group took advantage of this situation and started accusing the regime of not going through due formalities. Thus, the anti-Tokugawa group, justifying their movement by politicizing the Emperor, gradually developed an ideology advocating the Emperor's rule on the one hand and exclusionism on the other.

23. The state of confusion created by the confrontation between the pro-Tokugawa and anti-Tokugawa camps was reflected in the attitudes of foreign powers. For instance, France gave support to the pro-Tokugawa camp, while England basically maintained neutrality in this matter and did not openly rule out the anti-Tokugawa camp. Yet these foreign powers did not fail to penalize the forces advocating exclusionism.

24. The powerful Satsuma and Choshu clans, the most radical advocates of the exclusion of foreign powers, were attacked twice

(in 1863 and 1864) by the British fleet and the combined fleets of four countries. Smashed by these attacks, both clans gave up the idea of exclusionism and devoted themselves to opposing the Tokugawa family and advocating imperial rule.

25. In October 1867, having foreseen the gloomy future of the regime and recognizing the deterioration of military power, Yoshinobu Tokugawa, the fifteenth Shogun, decided to resign and give up his authority as the highest executive of the nation to the Emperor. This is what is known as the Meiji Restoration.

26. The new government took jurisdiction over all the territories that had been under the direct control of the Tokugawa regime. With this measure, the Tokugawa family became the heads of only a small local clan. A military confrontation occurred between the new regime and the sympathizers of the ex-regime over this treatment. The defeat of the latter was the final blow that terminated the political life of the Tokugawa family. It is interesting to know that those who manipulated to stop the military confrontation between the two were the consuls of foreign powers. They were very much afraid of the silk-producing areas in the eastern parts of Japan being drawn into warfare.

3. The Liabilities of the New Government

27. The Meiji government, in succeeding to political power, inherited enormous liabilities to foreign countries as well. In February 1868 the Tokugawa regime borrowed 500,000 dollars from the Société Générale bank of France for purchasing weapons when the confrontation with the anti-Tokugawa groups became inevitable. The repayment period was seven months; the rate of interest was 10 per cent per annum; and the Yokosuka Iron Mill, which had been constructed in 1865, with a loan of 2.4 million dollars from the French government was offered as mortgage. The new government had to repay this debt when it could not raise funds for post-war management. The

government asked Sir Harry Parkes, the British consul in Japan, to arrange a loan to cover the payment. The repayment period of this new loan was one year, and the rate of interest was 15 per cent. Moreover, the creditor, the Oriental Bank of England, asked the facilities of the Yokohama Custom House and its income as mortgage. Indeed, it was a crisis for Japan to have been colonized economically.

28. Facing this crisis, the government prohibited the local governments (formerly clans) from borrowing money from foreign countries on mortgage. In fact, according to a survey conducted in 1870, the amount of debt to foreign countries that the Tokugawa regime left unpaid was 6 million dollars, and another 4 million dollars were borrowed by thirty-seven feudal clans from foreign agents for the purpose of purchasing warships, weapons, etc. Silk, rice, and mineral products were the common items to offer as mortgage. The Tokugawa Shogunate on the eve of the Meiji Restoration did not have the capacity to control or settle these foreign debts.

4. Unequal Treaties

29. Around 1863, when the zeal for exclusionism was at its peak, nearly twenty foreign warships were always stationed in Yokohama port. After penalizing the exclusionism of the Satsuma and Choshu clans, the foreign powers demanded the right to construct a military station in Yokohama. The Japanese government had to provide 66,000 square metres of land and bore all expenses required for constructing and maintaining the governor-general's residence, barracks, hospital, powder magazine, etc. In 1869 there were three thousand British soldiers stationed there and a somewhat smaller number of French.

30. In addition to the military station claiming extraterritoriality, the foreign powers did not allow Japan to have autonomy on customs. According to the treaty concluded in 1854, import duties

ranged from 5 to 10 per cent of the imported value; this became 5 per cent flat rate in the Edo Treaty concluded in 1866. As a result of this unequal treaty, Japan suffered from excessive imports, drain of specie, damage to local textile industries, and distortion of the industrial structure. The new government continually asked the foreign powers to modify this unequal treaty. However, they refused to do so, demanding, instead, the opening up of additional ports and criticizing the ban on Christian missionary activities in Japan.

31. The unequal treaty had another side effect. After the opening of ports, diseases so far unknown to Japan began to be brought in. The spread of cholera in 1878 is a good example. Upon receiving news of the spread of cholera from the Japanese consulate at Amoy, the Ministry of the Interior tried to do maritime inspection and to segregate ships that had come through Amoy. However, Parkes, the British consul in Japan, refused to allow either the inspection or the segregation of ships. Fourteen thousand people suffered from cholera, and eight thousand died. The next year also preventive measures proposed by the government were refused by the consuls of England, France, and Holland. A hundred thousand people died of cholera in 1879. Similarly, over a hundred thousand people died of cholera originating in the settlement of Nagasaki in 1885.

32. The spread of cholera had impacts in two ways. First, oriental medicine gave way to Western medicine because the former failed to control the spread of cholera. Consequently, Western medicine became the officially recognized medicine thereafter. Second, since the government mobilized the police to implement preventive measures for cholera, the police force began to take part in the field of public health of the country.

33. In such circumstances, such Meiji leaders as H. Itoh and T. Ohkubo gradually became convinced that strong military power was essential to remain self-reliant in international political

dynamics, and that a powerful economy was a prerequisite for strong military power. This was the lesson that the Meiji élite derived from the aggressive attitudes of the foreign powers. And this realization led to a national development target which advocated strengthening military power and increasing the wealth of the nation by industrial development.

34. The national development target or basic strategy for nation-building took the form of developing export-oriented industries and import-substituting industries, particularly the ones related to military affairs. In this we can see the early signs of Japanese militarism.

5. Currency Problems

35. The victims of internal disturbance are always common people. Japan was no exception. In 1866, when the first civil war occurred, Japanese agriculture experienced an extremely poor crop. The increase in the demand for food grains particularly for military purposes and the disruption of traffic networks boosted the price of rice to a high level. In order to prepare for the civil war, every clan accumulated goods by issuing inconvertible notes. Farmers who received these notes realized that they did not have much purchasing power. As the farmers had already suffered from heavy pressures under the feudal regime, they rose in rebellion on a massive scale, demanding the re-issue of the convertible notes. In urban areas merchants, money-lenders, rice shops, pawn shops, wine shops, etc. were attacked. There was a problem of specie behind the anarchic situation created by the civil war.

36. By a treaty concluded in 1858 with five foreign countries, free entry of foreign currencies had been agreed upon. The prevalent international currency in Asian trade in those days was the Mexican silver coin. The standard currency in Japan was gold, and silver currency was subsidiary, with the conversion rate at 1 to 5.

The official exchange rate was set at three Japanese silver coins (1 per cent silver content) for one Mexican silver dollar. The international exchange rate between gold and silver was 1 to 15. Therefore, it was profitable for foreign traders first to convert Mexican silver dollars into Japanese silver coins and then exchanged them for gold currency; they could obtain three time the worth of international currency through this handling. For this reason, Japanese gold started draining abroad in a big way immediately after the opening of the port of Yokohama.

37. To cope with this situation, recoinage was inevitable to reduce the content of gold to a level comparable to the international conversion rate between gold and silver. This implied devaluation of the standard currency and caused inflation. Yet the Tokugawa regime had to increase the supply of currency to meet the demands of administration and defense. Since the Meiji government basically followed the same policy, peasant riots and social unrest continued. It was not until the 1890s that the authority of the new government was fully established throughout the country.

6. Institutional Reforms

38. The new government launched a series of reforms in various areas. Some of these were the abolition of the status-hierarchy system; establishing prefectures as a new administrative unit in place of the clans; securing freedom of occupation, cropping, and enterprising activities, etc. With these reforms the Japanese economy evolved into a free market economy. In addition to these reforms, the government introduced a constitutional parliamentary system in fear of democratic movements springing up. However, its final form suffered from substantial retrogression compared to the initial proposal. Similarly, freedom of speech was recognized, but with great limitations. These reforms and refreshments of the feudal institutions played an important role in giving people a feeling of emancipation and hope. At least people began to feel confident

that the world was changing in the better direction.

39. There is no consensus among Japanese scholars with respect to the revolutionary character of the Meiji Restoration. Yet nobody would deny the fact that it was a revolutionary change in modern Japanese history. There are some who point out that the uniqueness of the modernizing process in Japan compared to the cases of Korea and China lies in the fact that integration and compromise between exclusionists and those who advocated the opening of the country were made relatively smoothly.

III. CIVILIZATION AND ENLIGHTENMENT

1. Westernization

40. The damaging effects of "free trade" mentioned already had reached every corner of the country ten years after the first opening of ports to the outside. The principle of "free trade," which brought undue benefits to foreign countries, was accomplished through the unequal treaties aided by military power. In 1871 the then Premier Sanjo said that modernization of the legal systems and customary laws which were incompatible with those of the Western countries might be the only way for Japan to alter the situation regulated by the unequal treaties. Westernization as a target of modernization was thus set forth. In this connection, a survey mission consisting of political leaders was sent to Europe and the United States of America.

41. The deputy leader of the mission, H. Itoh, admitted the superiority of Western societies in every aspect and strongly advocated the necessity of transplanting Western civilization in order to upgrade Japanese society to the level of Western societies. The official report of the mission stated that the wealth of England was originally based on advantages in her mineral resource endowment; then she was successful in increasing business capacity by the invention of ships, railways, steam generated from fire heat, etc. She monopolized the textile industry and navigation and came to command over the world.

42. The importance of the textile industry and heavy industries—especially iron and steel, shipbuilding, and mining—pointed out by the mission report was channeled into the industrial policy of Japan thereafter.

43. To come back to the problems of unequal treaties, we have to note that it was in 1899, when Japan had gone through her industrial revolution, that extraterritoriality was abolished and autonomy in tariffs was restored.

2. Three Major Reforms

44. Many reforms were introduced by the new government, as we have mentioned already. However, the reforms of the education system, the draft system, and the revenue system are the most important ones to consider when we examine the modernization of Japan.

(a) The Education System

45. The proposed reform of the education system was to give compulsory education to children above the age of six by founding 53,760 primary schools, 256 middle schools, and 8 universities. However, administrative reforms such as the replacement of the clan system by the prefectural one and the creation of the Ministry of Education (1871) were necessary before this plan could be implemented.

46. The new education system of 1872 was too ambitious to function under the existing financial constraints. It might have been hard to recruit enough qualified teachers to run this system, at least above the middle school level. However, this was the situation at the beginning of modern education in Japan.

47. A statement of the then Premier made it explicit that the purpose of education was for the individual pupils to explore their

potentiality, and so it should be regarded as a productive asset for all. The textbook used initially in the primary schools was a translation of the Wilson Reader from the United States of America. Therefore, it clearly would need to be revised sooner or later so as to meet the needs of the nation. And, in fact, it was revised in 1879 and 1886. However, it should be noted that the basic idea behind the revision, as indicated in a statement by Arimori Mori, the then Minister of Education, was to shift the emphasis from education as a way of exploring the potentiality of the individual to education as a means of achieving the national development target mentioned already.

48. This shift of emphasis was perhaps an expression of the reaction of the Meiji élite to the difficult situation in and out of Japan; the civil war (anti-new regime) of 1878, the rise of the democratic movement demanding mass participation in politics, the establishment of the constitution, and the opening of the diet system. In other words, it was imperative for the new regime to establish itself and to stabilize and develop the country at the earliest possible time. Education was one of the means to achieve this objective.

49. In spite of this change in principle, primary school education was diffused all over the country, and teachers' colleges to supply primary school teachers were established in each prefecture under the new education system. However, a heavy financial burden for the construction of primary school buildings in rural areas was borne by local people in the form of local taxes and donations. Moreover, tuitions and fees were so high that the majority of farmers could not afford them. The rate of enrollment was as low as 30 per cent in 1877. In addition to the financial burden, farmers could not afford to spare important working hands. In some places farmers revolted against the enforcement of this compulsory education system. Generally speaking, however, the illiteracy rate decreased rapidly with the spread of education within a short

period of time, and this was accelerated following the development of industries after 1890.

(b) The Conscription Law

50. The Ministry of the Army proclaimed the conscription law in 1872. This was a corollary of the abolition of the status-hierarchy system, in which the warrior class had been responsible for defense and warfare. With the abolition of this system, the role that had been played by the warrior class became every man's duty regardless of his former status and occupation. It was reasoned that the defense of a country was analogous to protecting oneself from trouble.

51. The abolition of the status-hierarchy system gave the momentum for the military service to be modernized and democratized. Yet the re-organized military system was based on compulsory conscription, not on voluntary enlistment. Of course, even under compulsory conscription there were clauses providing for exemptions and postponements. Among those who were eligible for these clauses were the physically disabled, criminals, bureaucrats, students in national colleges, students studying abroad, professionals such as medical doctors, heads of families (or their proxies), and those who paid 270 yen as a substitute. Consequently, the healthy male population of farm households except for the head or heir became the main source of the national Army. It is clearly suggested that the government's intention behind this conscription policy was to fill the conscription quotas on the one hand and to secure qualified manpower and maintain the family system on the other.

52. The modern Army, besides its regular duties, provided opportunities to learn discipline and collective life for the young men drafted from all over the country. These young men who met in this way formed a new type of social group even after they left the Army. And the group of this kind functioned as an auxiliary agent

of the authority at the grass-roots level.

53. As mentioned, those who paid 270 yen were exempted from the military draft. This was one way of raising funds for maintaining the Army. Here we can see the evidence of plutocratic influence in the Japanese Army. Nevertheless, the conscription system could not achieve its initial objective because of these exemption clauses. In fact, the figures in 1876 tell us that 80,000 out of 3 million potential candidates were eligible for these exemption clauses and the government could draft barely 14-15 thousand men every year.

54. One reason for the unpopularity of the Japanese Army was the fact that most of the commissioned officers and non-commissioned officers were members of the former warrior class and, therefore, the class structure of feudal society was brought into the Army. The reflection of the class-consciousness of feudal times in the rank-oriented structure of the Army created an inhumane structure and psychology in which the lower-ranking soldiers from non-warrior classes were always victimized. The unpopularity of the Army continued despite the national development target except for the period after the victory of the Sino-Japanese and Russo-Japanese wars. The Japanese Army, however, was able to attract brilliant young men from middle-class families because they were exempt from tuition and fees at military schools, as at normal schools. And these young men became leaders of the modernized army.

55. The breakdown of party politics after 1910 radicalized these young military officers toward the right. Although the ultra-nationalism of these officers had a very different ideology from that of the leftist radical groups formed in the years before 1920 since the former represented nationalism and the latter inter-nationalism, still, as far as their basic policy on domestic affairs was concerned, they shared many things in common. This is attributable to the fact that most of the men under the officers'

command were from poor families in rural areas and the drain of these young men caused a deterioration of the household economy of their native homes. The young officers, under these conditions, could not be indifferent to arguments advocating social reform.

(c) Revenue Reform

56. The revenue reform introduced by the Meiji government was the most important and crucial aspect of the modernization process. The major source of revenue under the new regime, as in feudal times, was land revenue. In feudal times, however, this had not been a stable source of revenue; it was to be paid in kind, and the amount collected fluctuated substantially, depending on the harvest.

57. The new government introduced a revenue settlement over a period of six years (1873-79) in which the land revenue was to be paid in cash. The revenue rate was fixed at 3 per cent of the land value specified in a title-deed. The actual revenue burden at this rate, together with the local village tax amounted to as much as 34 per cent of the gross produce, which was almost equal to the burden in feudal times. Although farmers' discontent was great, the government could raise a stable fund for industrial development and the strengthening of military power free from market fluctuations and crop conditions. Here again we can see the decisive role played by the agricultural sector in the process of the modernization of Japan.

58. The effect within the agricultural sector of the revenue settlement was the progress of peasant disintegration, which was in practice accelerated by the change of revenue payment from kind to cash and the prolonged low price of rice. In this process, on one hand, wealthy farmers and landlords emerged, who accumulated land and then started investing their surplus in the non-agricultural sector; and, on the other, potential migrants to the urban industrial centres such as tenants and petty part-owners were created.

59. Another measure that the new government took in connection with the development fund was to terminate grants to the former warrior class. There were 400,000 households that had belonged to the warrior class, and their population (2 million) was roughly 6 per cent of the total population. Payments to these ex-warriors in grants amounted to 30 per cent of the government's total revenues. Therefore, the government decided to terminate the payment of grants and instead a lump-sum allowance in the form of bonds was paid. With this measure, except for a few who were of the ruling class in feudal times, most of the lower ranking ex-warriors suffered a great deal and sold out their bonds. Those bonds were purchased by merchants and money-lenders and then flew into the development fund.

60. Some of these lower ranking ex-warriors became government officers, teachers, etc., but most of them were ruined and joined the urban poor. The government spent a vast amount of money to rescue impoverished people, partly with an eye to maintaining public peace, but could not obtain good results.

61. There was another group of people who shared a similar fate to that of the lower ranking ex-warriors. They were privileged craftsmen who had exclusively supplied goods to the warrior class. Some of their industrial arts have been protected in some areas (e.g., Kanazawa City), but most of them disappeared in the process of industrial development. In addition to these people, urban areas had to accommodate migrants from rural areas who failed to adjust to the rapid changes, particularly after the revenue reform. Thus, urban problems were being generated even before industrialization. And it took several decades before some of these urban poor began to be absorbed in the industrial sector.

62. Continuous inflow of population in excess of the employment opportunities that urban areas could offer caused not only unemployment problems but also deterioration of residential conditions, spread of epidemics, formation of slums, etc. Under these condi-

tions, the jobs open to unskilled urban poor were largely in construction and public works as day labourers. Some healthy men found jobs in local transportation (e.g., rickshaw pullers). However, their income was so low that, in order to feed their families, their children had to do side work of various kinds such as labeling matchboxes.

63. They also worked as stall-keepers and peddlers. They could work more than 250 days a year by selling all sorts of daily necessaries at festivals held in various places. Their transactions were extremely small in scale, but the commodities they sold were of all varieties, ranging from flowers, garden plants, curios, and knives to medicine, foods, and wine. They were a part of urban life at least up to the beginning of the World War II.

3. Characteristics of Employment and Management Systems in Japan

64. In the current of "civilization and enlightenment," new types of urban industries emerged which manufactured goods such as shoes, bags, matches, soap, hats, Japanese sandals, carts, bricks, glasses, Western furniture, etc. These industries offered full-time employment opportunities for craftsmen. Since the wage rate was low in these industries, employers used to obtain workers using their personal relations in their native places or employing members of their kinship groups.

65. The wage rate of these craftsmen was low; but their wives and children were given subsidiary jobs within the factories or companies (e.g., maid-of-all-work, apprentice) or at home, and thereby they could obtain a subsistance income as a household. Some scholars call it a total employment system or whole-family employment system. When the head of a family had an accident or was retired from a company, his son was employed in place of his father. This unique relation between employers and employees can be observed even in modern Japanese enterprise. There are not a few scholars

who see this as the unique characteristic of the management system in Japan—quasi-family-type or affectionate relationship.

66. Here, we have to call attention to the attitude of these craftsmen as skilled hands toward their work and the unique method of training they had. For instance, their turn-over rate was unexpectedly high. This was because they believed that they could improve their skills by enriching their experiences in different places. Their sphere was surprisingly wide regardless of their occupations. Having had enriching experience in different places was the qualification for recognition as skilled hands, and their skills were also spread widely under this system. Employers needed to be able to assess the skills of these wandering craftsmen properly and promptly, and good craftsmen came to assemble around the employers who had such capacity. These craftsmen sometimes worked as apprentices for a fixed period of time without pay. And even after they became independent, their wage rate remained quite low. For them, it was their skills that they were proud of, not the level of their income. However, such aristocraticism and aestheticism were disturbed by the enforcement of the conscription law, since the maximum period allowed for their training was up to 20 years old. Consequently, the level of skill was kept stagnant.

67. One of the chances for these wandering craftsmen to settle down was given by marriage. This was justified for two reasons; they were enabled to take apprentices and to earn a subsistence income if their wives could obtain subsidiary employment.

68. The case of unskilled migrants from rural areas was quite similar to that of the craftsmen. However, the character of the relationship between employer (who in many cases was a subcontractor) and employees in this case was rather that of patron and clients, with the employer providing not only food, clothes, and shelter but also necessary expenditures in connection with social functions in addition to the bonus payment twice a year.

69. The employment system described above was quite popular in public works and metal-mining industries. This system had an inherent mechanism of exploitation; however, it was true at the same time that it provided social security in a private manner to these proletarians, who had freedom from unemployment.

70. These two cases show an interesting contrast. Craftsmen tried to brush up their skills under uncertainty, while unskilled laborers consciously tried to seek security. This difference can be attributed to the fact that the former had an invisible asset to be proud of and the latter did not have anything to rely on. In any case, it is appropriate to point out here that the efficient organization and leadership that the employers of the latter had and the important role played by personal relationships common to both cases are not observable in the modern sector.

71. The permanent-employment system in Japan came to be formulated by the 1930s, when the country entered the second phase of "civilization and enlightenment" and the policy to enrich the nation by industrial development. It was motivated by the necessity of retaining capable technicians and craftsmen and of coping with the rise of the labour movement led by leftists. Some may find here a reversion to the quasi-family-type relationship in the management system in Japan. The permanent-employment system has functioned in two ways to date. One has been to create a competitive situation within the enterprise in terms of loyalty and promotion by introducing the job-ranking system. The other has been to direct trade unions' efforts toward pressing managerial staffs hard with respect to their ability to run the business on a sound basis, rather than to promote horizontal linkages with other unions of similar occupational category.

72. The seniority system in wage payment popular in Japanese enterprises is one in which loyalty and contribution to the enterprise are basically measured by the length of career. This has the

advantage of securing a livelihood for all employees, but an individual's skill or talent tends to be evaluated relatively low under this system. It is important to note that this system was supported by the trade unions during the periods of inflation immediately after the war and of the high economic growth starting from the mid-1950s.

IV. ENHANCEMENT OF PRODUCTIVE CAPACITY AND INDUSTRIAL DEVELOPMENT

1. The Introduction of Foreign Technology

73. It is misleading to state that modern Western science and technology began to be introduced in Japan after the Meiji Restoration. They were known already in feudal times. However, the main emphasis in those days was placed on the introduction of military science and technology. Although the Meiji government continued to import Western military science and technology, one notable difference was that the introduction of science and technology for non-military purposes increased substantially. Another difference is that the introduction of science and technology during the feudal period was in the form of the import of finished goods, while after the Meiji Restoration efforts to reproduce imported technology began to be made. This copying process started with learning the operation, repair, and maintenance of imported machines, for instance, and gradually went on to manufacturing similar ones appropriate for the country.

74. Among the characteristics of technology transfer during the Meiji period are that the introduction of technology was made in diversified fields on a large scale, and that vigorous efforts were made toward home production. There were good reasons for the encouragement of home production. First, imported machines and plants were extremely expensive. Second, it often happened that obsolete machines and plants were imported at exorbitant prices.

75. It took a long process of trial and error to learn to reproduce imported finished goods and machinery. For example, an attempt to manufacture textile machines was made in the government machine tool factory, but it resulted in complete failure. On the other hand, efforts to manufacture locomotives were successful. The first railway service was opened between Tokyo and Yokohama via Shinagawa in 1872. Upon the arrival of locomotives designed by Japanese engineers and manufactured in the United States of America, one of them was disassembled immediately after delivery and a similar one was manufactured in 1893. Since the private sector could not afford to take the risk of such venture, government factories had to take the initiative.

76. There were factories often called shipyards or iron and steel mills; however, in practice, they manufactured motors for use in ships and textile industries, and machines for use in mining. The first full-scale shipyard was constructed in 1855 with the technical collaboration of Holland, costing a vast amount of money and three and a half years' time. It was originally attached to the Navy School but was turned over to the Mitsubishi Company in 1878. Construction of a full-scale iron and steel mill started in 1865 at Yokohama, aiming at manufacturing weapons. Industrial development in the early Meiji period was possible on the basis of these industries.

77. Industrialization in Japan developed primarily in reaction against the military intimidation by foreign powers, which was directly linked to the economic menace. Therefore, the process of industrialization began with shipbuilding first, then iron and steel manufacturing and mining, unlike in Europe, where the reverse order was typical. The Meiji élite had to face all sorts of difficulties arising from this reverse process of industrial development. It was around the 1890s that Japan reached the stage of industrial revolution, and it was completed with the indemnity from the Sino-Japanese War (1894-95). Water power used for industries began to

be replaced by steam power in the late 1880s.

78. The second stage of industrialization, starting in the 1910s, was characterized by the establishment of an integrated full-scale operation in iron and steel mills; self-sufficiency in the production of iron, cement, and glass; independence of heavy industries and the chemical industry; and electricity as the major source of energy.

79. The Meiji government established the Ministry of Industry in 1885. This ministry allocated 3 million yen as a fund for development. Of the 54 per cent of this amount spent during 1873-76, 80 per cent was allocated to the construction of railways and the government mines. The remainder was spent on heavy industries such as shipyards, telecommunications, etc. The pattern of allocation of government funds would provide useful materials for examining the problems of technology transfer in the process of economic development.

80. The initial policy of the government toward railway construction and management was that the government would be responsible for the main lines and the private sector for local lines. However, this plan did not materialize because of financial constraints. Some parts of the trunk line were constructed by private companies and later bought up by the government.

81. In contrast to the case of the railways, the private sector was encouraged to develop marine transportation from the beginning. For instance, having taken advantage of the Taiwan (Formosa) expedition, the Mitsubishi Company enhanced the relationship with the government and drew out subsidies and obtained ships disposed of by the government free of charge. The government's intention in this decision was to eradicate the American Pacific Mail Steamship Company from the coastal routes. Although the Mitsubishi Company thereafter grew to be the largest company in marine transportation in Japan, it

also served the purpose of protecting national interests. A characteristic of the Meiji business élite, such as E. Shibusawa, was that they were always conscious of the national interests, and, in fact, most of the companies founded by the ex-warriors using the bonds as capital specified this aspect in their articles of association. Their loyalty to the country was often disguised as loyalty to the people and they tended to ignore co-operation with the local communities and the consideration of environmental problems.

82. As far as the development of road transportation is concerned, the central government designed the overall plan and the expense of actual construction was borne by the local governments. This was basically in line with the policy that had been adopted by the feudal clans. It was in contrast to the case of the railway, in which the concession for railway construction between Edo (Tokyo) and Yokohama had been given to Portman, a member of the American consulate, just before the end of the Tokugawa period.

83. The location of the main railway lines was a controversial issue. The army leaders preferred the central part of Japan on political and defense grounds. However, the final decision was in favor of coastal area along the Pacific Ocean. Transportation problems that the government faced during the civil war of 1878 had an effect on this decision.

84. Although the construction of main lines was aimed at meeting the demand arising from industrial development, it was primarily motivated by political and military requirements. Therefore, the army participated in designing the timetable for railway transportation, and the consideration of profit and loss was out of the matter.

2. Technology Transfer in Three Major Fields

85. According to a historian of scientific technology, there are three areas in which foreign technology was effectively introduced in the Meiji period: the Mint in Osaka (1871), the Tomioka Silk Mill in Gunma Prefecture (1872), and railway construction between Tokyo and Yokohama.

86. We have discussed already the problems of recoinage of gold currency and the resultant inflation that Japan faced immediately after the opening of ports to the outside. The Meiji government inherited this state of affairs, and, therefore, it was an important task for the government to settle the matter relating to specie domestically as well as internationally. After a close examination of foreign currencies, it became clear that each coin was strictly standardized in terms of size and quality. From this fact, the government came to realize that the introduction of foreign technology was inevitable.

87. The process of coinage was divided into two parts: a chemical process and a machine process. The technology for the latter process was relatively easy to acquire, but the former process required a basic knowledge of chemistry and metallurgy. However, the technology applied in manufacturing cannon during the late Tokugawa period was of great help in this respect. At the same time, the traditional technology of chasing swords and helmets played an important role in designing and chasing the new currency. In this way the new currency, standardized in quality and difficult to copy, began to be produced at home.

88. The government efforts to produce specie at home activated the metal-mining industry. Production of gold, silver, and copper increased with the introduction of new technology, particularly the process which made it possible to collect metal out of refuse. Labour productivity increased drastically with the mechanization of drainage and transportation. Imported technologies in these areas were far superior to the indigenous ones.

89. In spite of the technological innovations, the organization and skill of labourers remained unchanged. The implements they used were simple, and the efficiency of production, therefore, relied heavily on their skills. The job of mine workers was risky. There was good reason for them to form small work units called tomoko, consisting of a leader who was respected and rich in experience (with skill and knowledge of safety) and members who were also ranked according to their skills and experience. Since the leaders of these tomoko groups were conscious of and responsible for the safety of their members, any technology to be introduced had to get their consent.

90. With regard to mineral resources, the Meiji government inherited the direct control system over the development of mineral resources from the feudal regime. In 1873 the government passed the Mining Act, which prevented foreigners from owning mines and from becoming mine workers. C. Netto, who was invited by the government to run the government-operated Kosaka Mine and later contributed greatly to the spread of mining and metallurgy in Japan while he taught at the University of Tokyo, also reluctantly admitted the reasons behind the Mining Act of 1873. He was of the opinion that the urgent and easy way to develop mines was to employ foreign experts. However, he was also aware that Japan might become involved in difficult diplomatic problems arising from the influx of less-expensive Chinese labourers if the development of mines were commissioned to foreign hands.

91. While we are considering the subject of specie, it is worth pointing out that the metric and decimal systems were adopted by the government in 1871 when the mint was established in Osaka. It goes without saying that the impact of the metric and decimal systems went beyond the problems of specie, weights, and measures.

92. Before entering into the discussion of textile industries, let us refer to the media of introduction of new technology. In the 1850s and 1860s the level of modern industry and the quality of

labour in China were higher than in Japan. A considerable number of books on science and technology written in Chinese were published and widely read. This is attributable to the efforts made by Christian missionaries. Books on Western science and technology translated into Chinese had a profound impact when few could understand European languages. In Japan the introduction of science and technology was attempted most enthusiastically by the newly formed Navy. The Navy was modeled after the British Navy, so technical terms which used to be Dutch in feudal times began to be replaced by English. And in this respect, books on science and technology in Chinese played an intermediate role in disseminating new knowledge which was accessible to any intellectuals of traditional culture.

3. Silk and Cotton Mills

93. Silk and cotton mills were the leading sectors in the first half of the history of industrialization in Japan. Silk production was recognized as an export industry and cotton production as an import-substitution industry. Cotton cloth had become popular for common people in place of flax, but the consumption of silk was confined to a limited circle. The major producing areas of cotton were the western parts of Japan, while silk was produced mainly in the eastern parts.

94. Silk was the most important earner of foreign currencies. Silk-reeling technology in Japan lagged behind that of China, but it could capture the international market for the following reasons: first, the stagnation of silk production in China because of the Taiping Rebellion (1851-64); second, the spread of corpuscle disease in France, the major producing area in Europe; and, third, the cheap price of Japanese silk, which was almost one half the international price.

95. However, the silk exported from Japan was used only for warp in Europe, mainly because the denier was irregular for technical

reasons. The government tried to disseminate new technology in the Tomioka Silk Mill, the government-operated pilot mill founded in 1872. All machines and equipment were imported from France, and French experts were also invited. An unexpected problem, however, occurred: female workers could not be recruited. Information on Western societies was extremely limited in those days and wild rumours of all kinds were spread in rural areas and nearby towns. The wine that Europeans drank was rumoured to be human blood, and so people feared that those who went to the silk mill might not be able to return home alive. The government, therefore, passed an order that every village and town should supply fifteen female workers of 13 to 25 years of age. However, people refused to send their daughters on the grounds that the daughters of headmen in those villages and towns were not sent to the mill.

96. The author of Tomioka Diary, E. Wada, was the daughter of a village headman in Matsushiro, Nagano Prefecture, who was sent to the Tomioka Silk Mill together with sixteen other girls. She was then 15 years old. After working a little more than a year at Tomioka, she came back to her native town and became a technical leader of the newly established silk mill there. According to her observation, the equipment and buildings of the newly established mill at Matsushiro were inferior to those of the mill at Tomioka: wood was used in place of copper, iron, and brass; wire was substituted for glass; and brick floors became earth floors. Though these capital-saving modifications were made to take into account the capital-bearing capacity of the local people, silk was produced fairly well. And those who adhered to the indigenous technology had to face the reality that the silk produced in these poorly equipped mills was sold to the foreign buyers at a handsome price. The Tomioka Silk Mill went bankrupt as a result of the establishment of these capital-saving mills in various parts of Japan, but its historical role should be evaluated.

97. In connection with the Tomioka Silk Mill, there is one thing to

be noted. The initial success of Tomioka was attributable to the fact that the managers of this mill learned a lesson from the case of failure of a mill located at Maebashi, 40 kilometres north of Tomioka. The main cause of failure was that people resisted learning from foreign experts and hated to introduce a new mode of production because there was no division of labour between sericulture and silk reeling in this town, and the control of wholesale dealers was strong enough to block the introduction of any new system. These two cases suggest to us the importance of channels and agents of technology transfer: the wrong combination of these two invites cultural as well as economic tensions. Generally speaking, how to disaggregate the whole production process (sericulture, silk reeling, weaving, dyeing) economically and where to mechanize ultimately determine the direction of technology transfer. Cotton spinning was no exception.

98. As far as the cotton textile industry is concerned, the disaggregation of the production process (cotton growing, spinning, weaving) was made before the Meiji period. Since this disaggregation took the form of a regional division of labour (i.e., one region specializes in one part of the process), introduction of foreign technology did not bring cultural conflicts. The only problem here was the competition with the less-expensive imported cotton products.

99. Cotton was one of the important cash crops in Japan. Therefore, the development of the cotton textile industry and its competitiveness were of grave concern to the cotton growers. The government planned to establish small-scale cotton mills (2,000 spindles) in various places after a successful trial in the government-operated mill. For this purpose, the government decided to dispose of ten plants imported from England to the private sector, the cost of which was payable on a ten-year installment basis. No interest was charged.

100. The result was far from satisfactory, since two thirds of these mills went bankrupt within ten years' time. The reasons for this poor performance can be listed as follows: First, 2,000 spindles were too few to run the mills economically. Second, the water-wheels used as a source of power were unable to operate efficiently when rice transplanting started or during the summer, when water became scare. Third, there was a shortage of skilled workers and technical staff and a lack of capital to employ foreign experts, and the supply of raw material was not sufficient in quantity or quality to run the mills at full capacity.

101. Cotton mills became viable only with the imported modern plant designed to achieve scale of economy. Electric lighting, though quite expensive in those days, began to be used, greatly reducing the risk of fire and also making possible the introduction of the two-shift system learned from India. In these large-scale cotton mills Indian cotton began to be used in place of Japanese cotton, which resulted in a disastrous effect on the cotton-growing areas in the western parts of Japan. These areas, however, turned out to be the places where rural-based small-scale industries producing such items as brushes, shell buttons, lenses, etc. had developed.

102. The first modern factory to produce shell buttons was founded by a foreign merchant at Kobe City. Those who learned the technique at this factory were successful in disaggregating the production process into more than ten parts. These disaggregated parts were simplified further to the extent that they could be transplanted to rural areas. These disaggregated parts were developed into rural industries employing the capital-saving and labor-intensive methods, and these industries provided part-time employment opportunities for rural people. The modern factory went into bankruptcy with the development of these rural-based industries which had close linkages with wholesale dealers in urban areas.

103. As has been discussed, silk reeling and cotton spinning were the leading industries in the initial stage of industrialization in Japan. However, the former developed as an export industry, after absorbing modern techniques, based on a small-scale, capital-saving, and labor-intensive method. In contrast, the latter developed initially as an import-substitution industry and later into an export industry based on a large-scale, capital-intensive, and labour-saving method.

104. In both industries the overwhelming majority of workers were daughters of poor rural households. In those days Japanese agriculture was characterized by a deteriorating land/man ratio, exposure to the impact of international economy, mono-culture of rice, and destitution of the rural economy.* Many of these female workers suffered from various diseases, particularly tuberculosis, due to the hard and long hours of labour under inferior working conditions. Besides, bound by advance payment handed over to their parents in the name of contract, the only way they could protest was by flight. However, the next jobs available for these runaways were worse.

105. The twenty years of industrial history in Japan beginning from the end of the nineteenth century were full of tragic stories about these young female labourers. The textile industries, both silk reeling and cotton spinning, began to suffer from a shortage of labour, particularly skilled labour, which enhanced the competition of recruitment among factories. The shortage of engineers was serious. There was an example that an engineer trained abroad had

* The destitution of farmers was reflected in the frequent occurrence of tenant disputes. The agricultural policy of the government had been to foster owner farmers, but the tenant disputes forced the government to pass the Tenancy Adjustment Law in 1924. Enforcement of this law was practically borne by the Officer of Peasant Affairs stationed in each prefecture. Successful implementation of the post-war land reform was partly attributable to the detailed records kept by these officers.

to rotate among three different factories—two days a week in each factory. The increase in the cost of recruitment and advance payment and the shortage of skilled workers intensified the degree of watch and restraint over the female workers. Dormitories and compulsory-savings systems were instituted and popularized as preventive measures against desertion. The savings of those who left a job before the end of the contracted term were confiscated. Efforts for the retention and recruitment of workers took different forms in large-scale and small-scale mills: improvement of welfare facilities in the former case and intrigue and violence in the latter.

4. Iron and Steel Mills and Foreign Experts

106. The Meiji government wanted to build warships at home. This was analogous to the target set by the Tokugawa regime of manufacturing cannon at home. It may not be too much to say that this was the objective of industrialization in the Meiji period. Warship-building required modern science and technology. Development of iron and steel was imperative for this purpose.

107. In 1880 the government established an iron and steel mill at Kamaishi, in the eastern part of Japan, when the small-scale textile industries equipped with 2,000 spindles were being set up in various places. Opinion was divided between an English engineer and T. Oshima, the responsible person on the Japanese side, on such issues as the location of the plant, routes of transporting iron ore, the method of procurement of water and fuel, and above all the working conditions of labourers. The government adopted the plan proposed by the English engineer. However, the mill had to be closed six months after the initial kindling of a furnace due to accidents such as fire and coagulation.

108. Twenty years later (1901) the Yawata Iron and Steel Mill set up by the government went into operation with the technical col-

laboration of Germany. Again, it ran into trouble one year after its inaugural kindling, mainly because of a design mistake; the plant, modeled after German ones, was not suited to the iron ore and fuel available in Japan. The problem was solved by the import of suitable raw materials from China. A lesson to be learned from this example is that mere transfer of advanced technology and its replication lead us nowhere.

109. In any case, the Yawata Iron and Steel Mill finally found its way and developed to the extent that iron and steel were produced in an integrated production system. However, like other heavy industries in Japan, the raw materials were imported from abroad and the only asset this industry had was skilled manpower and technical know-how. Thus the Yawata mill was successful from a technical point of view, but, economically speaking, it took more than ten years before it could produce a profit. The increase in demand known as "iron hunger" caused by World War I made this possible. The slogan "Iron is the base for nation-building" supported and encouraged engineers to stand for the long process of trial and error in this industry. Yet it should be noted at the same time that the Yawata Iron and Steel Mill could survive for a long time without making a profit and ignoring people's protest against pollution since, after all, it was a government-operated enterprise.

110. It is often the case that success and risk could be two sides of the same coin. K. Noro, a metallurgist who opposed the commissioning of foreigners to design the plant at Yawata, had to resign from his office at the initial stage of its operation. However, the first failure of this mill brought him back. He found that the problem lay in the coke. In fact, Japan did not produce good coke. Noro finally found the solution to this problem. His re-appointment suggests to us that politics and nepotism prevalent in the public sector caused great loss to the country.

111. Noro said, "People say that technology has no boundary. However, in its actual application, each country has to make an appropriate modification to fit the local conditions. Success can be expected if each recipient country of foreign technology is ready to undertake this creative work." The notion of appropriate technology was already made explicit at the beginning of this century.

112. Even in the successful case of silk reeling in Japan, it took almost twenty years before the Italian direct reeling method was replaced by the indirect reeling method, and "Kennel" system in raw-silk reeling began to be used instead of the French method known as Chambon system. A variety of improvements were made in sericulture and mulberry growing which reached a peak just on the eve of World War II. The war destroyed the stable international markets for silk products, and this ended the industrial life of these appropriate export goods produced by appropriate technologies.

113. It is important for human and social development not to apply foreign technology naively, but to make it appropriate carefully. Technology can be made appropriate if it is used to produce appropriate commodities and can find appropriate markets. Let us illustrate with an example.

114. One of our collaborators, A. Tamaki, has pointed out that land was excessively developed compared to the availability of irrigation water in the late seventeenth and early eighteenth century. The only frontier left for Japan in the Meiji period was Hokkaido. The development officers of the Meiji government relied on the advice of foreign experts. They recommended the introduction of North American-type agriculture, with the development of dairy farming and cultivation of potatoes. It appeared to be a reasonable proposal, suited to the ecological conditions of Hokkaido, and in fact it proved to be successful in some places. However, ironically enough, such success did not come from the application of North American but of Danish-type farming.

115. It is interesting to notice that, in parallel with the long and desperate efforts to naturalize the Danish-type agriculture, the settled farmers in Hokkaido also persistently tried to grow rice in this semi-arctic region. Efforts to improve seed were continuously made by farmers, universities, and the government experiment stations. Hokkaido today is the largest rice-growing area in Japan.

116. As the farmers were aware by experience, the length of daylight required for rice growing was longer than mainland Japan. A more important reason for the farmers to grow rice was that the satisfaction obtainable from rice was much greater than from wheat. It is a recent finding by nutritionists that the calories obtained from rice produced per unit of land is twice as high as from wheat. The adherence of the farmers to rice cultivation was thus proved to be rational. I do not know how the development officers and foreign experts in those days would react to the present-day rice cultivation in Hokkaido. However, what should be stressed here is the fact that the farmers in Hokkaido have kept on growing rice despite the fact that the labor input required for rice cultivation was three times as much as for wheat.

117. A similar example can be found in the World Bank project to reclaim waste virgin land in Kushiro-Nemuro after World War II. Many of those who settled there with the hope of developing mechanized farming had to leave, since the Jersey cattle that the World Bank experts recommended could not find an appropriate market. Only those who switched to keeping Holstein cattle and who also could leave their farms temporarily for part-time jobs found ways to settle there. This example raises a question with regard to the effectiveness and limitation of foreign experts. It also reminds us of the metallurgist K. Noro, whom we mentioned above. I would like to believe that a person like Noro is somewhere making efforts jointly with settlers for human and social development through appropriate technology transfer.